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Application No.: 09/707,269

Case No.: 53415US038

REMARKS

Claims 16, 19-26, 29-38, and 41-43 are pending. Reconsideration of the application in view of the following remarks is requested.

I. Claims 16, 19-26, 29-38, and 41-43 are Not Obvious over Kaufman et al. (U.S. Pat. No. 5,954,997) in view of Mueller et al. (U.S. Pat. No. 5,958,288)

Claims 16, 19-26, 29-38, and 41-43 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kaufman et al. in view of Mueller et al. Applicants request reconsideration of this rejection because the combination of Kaufman et al. and Mueller et al. does not teach or suggest a working liquid that comprises a buffer comprising a polyprotic protolyte having at least one pK_a greater than 7, as recited in Applicants' claims.

As a preliminary matter, Applicants' previous responses also address this issue. Those arguments are not repeated herein, but continue to apply.

The Office Action asserts "Kaufman taken alone discloses the composition without abrasives (col. 8, lines 43-50)." The cited passage mentions only the oxidizing agent, an aqueous medium and a concentrated dispersion of metal oxide abrasive. It is silent with respect to other components of the CMP slurry of Kaufman et al. At best, the cited passage from Kaufman et al. may be said to teach that abrasive slurries may be assembled by an order of addition in which there is an intermediate composition that is free of abrasives, but it does not teach a working liquid comprising an oxidizing agent, a complexing agent, a passivating agent selected from the specified group, and a buffer comprising a polyprotic protolyte having at least one pK_a greater than 7. The mere existence of an incomplete precursor to the functional slurry of Kaufman et al., which precursor does not include the abrasive particles, does not provide the missing components of the formulation of the pending claims.

The Office Action acknowledges that Kaufman et al. desire the abrasive function (see, for example, col. 7 line 1, which affirmatively states that the invention of Kaufman includes an abrasive.) Nothing reported by Kaufman et al. suggests that an abrasive free working liquid is useful for CMP. One skilled in the art reviewing the disclosure of Kaufman et al. would readily recognize that the various components do not become a CMP composition until abrasive

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particles are present. The CMP slurry ingredients reported by Kaufman et al. include abrasive particles, water, "an acid, base, or amine" (amines usually being bases and necessarily acidic or basic if they are to alter the pH of the CMP slurry), a complexing agent, and a film forming agent (col.4, lines 10-11). The disclosure of Kaufman et al. explicitly requires an abrasive, teaches that metals are undesirable elements of a CMP slurry, and fails to provide the necessary buffer comprising a polyprotic protolyte having at least one pK_a greater than 7.

The Office Action relies upon the background provided by Kaufman et al. to provide teaching that some CMP slurries (Cadien and Feller, '370) have used buffers as components of abrasive slurries. To this, the Examiner adds the general statement that Kaufman et al. desire to "maintain" pH within (broad) ranges, "about 2 to about 12" and "about 4 to about 9" which certainly does not require a buffer to achieve. The passages at columns 9 and 10 specify a single value and a narrower range of pH values that were measured, however, there is no indication that they were maintained or that they were in any way critical to the performance of the abrasive slurry other than falling within the broad, general ranges indicated. The issue to be addressed is not that buffers have been used in CMP slurries, but rather that buffers having specific characteristics, used in combination with other elements, have not been disclosed.

It should also be noted that Kaufman et al. teach, at the column 8 passage cited by the Office Action that the acid or base used to adjust the pH of the CMP slurry "contains no metal ions" and teaches away from systems that contain them, characterizing them as "undesirable metal components". A buffer necessarily requires the presence of the *salt of the weak acid* (or base) and the conjugate base (or acid) as confirmed at page 113 of the Kenkel reference cited by the Examiner. While the acetic acid of the Cadien and Feller '370 reference referred to in column 2 by Kaufman et al. is a weak acid, it is neither a polyprotic protolyte nor is its pK_a (4.75) greater than 7. Again, the mere mention that a component has been used in CMP slurries does not provide motivation for its use in the absence of specific teaching of its desirability in combinations with other elements of the prior art, especially when the reference in question, Kaufman et al., teach that metal ions, a usual component of the necessary salt of the weak acid, are not contained in their pH adjusting components and further teaches that abrasive particles, absent from the pending claims, are a required element of their slurry.

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Cadien and Feller's acetic acid buffer is functional because their slurry also contains metal ions contributed by potassium ferricyanide and potassium acetate. Applicants agree that buffers are known to control pH of aqueous solutions and that certain buffers have been used to control the pH of certain CMP abrasive slurries, however they respectfully disagree that buffers formed from polyprotic protolyte having at least one pK_a greater than 7 have been taught in combination with an oxidizing agent, a complexing agent, a passivating agent selected from a specified group in a working fluid substantially free of loose abrasive particles. Even were one to ignore the teaching of Kaufman et al. that abrasive particles are necessary in the reported slurry system, other elements not provided by Mueller et al., remain missing. Mueller et al. only add a catalyst having multiple oxidation states to the list of known ingredients and does not indicate how the addition of metallic elements, to be avoided as pH adjusting components, as catalysts overcomes the deficiencies of Kaufman et al., specifically the absence of a buffer comprising a polyprotic protolyte having at least one pK_a greater than 7.

Mueller et al. disclose polishing compositions having an oxidizing agent and a catalyst having multiple oxidation states. The reference has been added to Kaufman et al. apparently for the purpose of justifying the removal of the abrasive particles from the slurry of Kaufman et al. The required catalysts reported by Mueller et al., metals having multiple oxidation states, are listed at col. 5, lines 23-46. The only optional slurry additives taught by Mueller et al. are listed at col. 7, lines 38-22, and do not include the elements of the pending claim. To make the combination suggested by the Office Action, one would need to ignore the teaching of Kaufman et al. that affirmatively state that the slurries contain abrasive particles (column 7, line 1) and the statement that metal components, such as the catalysts of Mueller et al., are undesirable. Thus, the alleged combination is without motivation found within the references and is counter to the teachings of Kaufman et al.

The Office Action discusses Kaufman et al. and the teachings of Kenkel and reaches the puzzling assertion that the composition includes acetic acid or phosphoric acid in combination with "hydroxide" to inherently include a buffer in the composition. Applicants note that the various components listed at the background passages cited by the Office are from indirectly related references and are selected from lists with no motivation to combine and no teaching that they were combined in Kaufman et al. The components would be present together only if one

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used both an acid, e.g., acetic acid, and a base to adjust pH into the desired range rather than only one or the other as appropriate. The cited passage of Kaufman et al., however, clearly indicates that the components specified to adjust the pH are used in the alternative:

It is desirable to maintain the pH of the CMP slurry of this invention within a range of from about 2.0 to about 12.0, and preferably between from about 4.0 to about 9.0 in order to facilitate control of the CMP process. Slurry handling problems and substrate polishing quality problems are encountered when the pH of the CMP slurry of this invention is too low, e.g., less than 2. The pH of the CMP slurry of this invention may be adjusted using any known acid, base, or amine. However, the use of an acid or base that contains no metal ions, such as ammonium hydroxide and amines, or nitric, phosphoric, sulfuric, or organic acids are preferred to avoid introducing undesirable metal components into the CMP slurry of this invention.

Kaufman et al. at col. 8, lines 22-33 (emphasis added). In the absence of any indication that the slurry of Kaufman et al., especially in the absence of the abrasive particles that make it useful as a chemical mechanical polishing slurry, *resists changes* in pH when a strong acid or base is added or when the solution is diluted with water, there is no indication that the slurry or solution is buffered.

For at least these reasons, the rejection of claims 16, 19-26, 29-38, and 41-43 under 35 U.S.C. § 103(a) over Kaufman et al. in view of the Mueller et al. should be withdrawn.

II. C claims 16, 19-26, 31, 36-38, and 41-43 are Not Obvious over Kaufman et al. (U.S. Pat. No. 5,954,997) in view of Hudson (U.S. Pat. No. 5,972,792)

Claims 16, 19-26, 31, 36-38, and 41-43¹ stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kaufman et al. in view of Hudson. Applicants request reconsideration of this rejection because the combination of Kaufman et al. and Hudson do not teach or suggest a working liquid that comprises a buffer comprising a polyprotic protolyte having at least one pK_a greater than 7, as recited in Applicants' claims.

As discussed above, Kaufman et al. fail to teach or suggest the use of a working liquid comprising an oxidizing agent, a complexing agent, a passivating agent selected from the

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specified group, and a buffer comprising a polyprotic protolyte having at least one pK_a greater than 7. Similar to the discussion of "buffers" in reference to Kaufman et al. above, Hudson's "controlled pH" neither requires or suggests that a buffer is necessary or desirable.

Further it is unclear what would motivate the combination of elements from these two dissimilar references: (1) Kaufman et al. - a slurry with required abrasive particles, and (2) Hudson - a working fluid from which such particles are absent. Kaufman et al. teach that the abrasive particles are required (col. 7, line 7) while Hudson (col. 6, lines 21-30) teaches that abrasive particles undesirably wear down fixed abrasive pads. The proposed combination encounters several barriers. Kaufman et al. are working in the field of three-body slurry polishing of semiconductor wafers and require the presence of abrasive particles, while Hudson comes from the field of two-body fixed-abrasive polishing and warns against the use of conventional slurries, such as those used by Kaufman et al., which "wear down fixed-abrasive pads, and thus they reduce the effectiveness and the useful life of fixed-abrasive pads." Neither reference teaches a buffered, particle free working liquid having the required elements.

For at least these reasons, the rejection of claims 16, 19-26, 31, 36-38, and 41-43 under 35 U.S.C. § 103(a) over Kaufman et al. in view of the Hudson should be withdrawn.

III. Conclusion

In view of the above, it is submitted that the application is in condition for allowance. Reconsideration of the application is requested. The Examiner is invited to contact Applicants' undersigned representative with any questions concerning Applicants' application.

Respectfully submitted,

Date

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¹ Although rejected in the Office Action, claim 27, 28, and 39 have been previously canceled by Applicants and will not be further in this response.